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(12) PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. AU 199537880 B2
(10) Patent No. 712320

(54) Title
Granular fertiliser with supplemental coating

(51)⁶ International Patent Classification(s)
C05G 005/00 C05G 003/04
C05G 003/00

(21) Application No: 199537880

(22) Application Date: 1995.11.15

(30) Priority Data

(31) Number	(32) Date	(33) Country
264921	1994.11.15	NZ

(43) Publication Date : 1996.05.23

(43) Publication Journal Date : 1996.05.23

(44) Accepted Journal Date : 1999.11.04

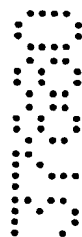
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ABSTRACT

The invention comprises a fertiliser pellet or granule which serves also as a vehicle for minor ingredients. Each granule has a core comprised of a first composition and a coating comprised of a second composition. The second composition is bound together and onto the granule by means of a water-soluble glue of a type which sets on drying. The invention also includes a method for making fertiliser pellets or granules comprising the steps of, mixing a water-soluble glue in water, evenly mixing the trace element salts with core granules, adding the glue and water to the mixture, and optionally drying and packing the resulting coated granular fertiliser.



AUSTRALIAPatents Act 1990

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GRANULAR FERTILISER WITH
 SUPPLEMENTAL COATING.

Details of Associated Provisional Applications -

Numbers :

The following statement is a full description of the
 invention including the best method of performing it
 known to me.

FIELD OF THE INVENTION

- 5 This invention relates to the field of phosphatic fertilisers including mineral supplementation, and to the field of applying an adherent coating including supplementation to granules of phosphatic fertiliser.

BACKGROUND

- 10 Fertilisers are spread on land in order to provide plants and indirectly animals that eat the plants with inorganic elements that are in short supply in the locality, hence providing an increased volume and quality of growth. Granules are preferred as they are easier to handle and distribute, and they tend to fall onto the ground rather than lodging in foliage or being blown onto the wrong paddock.

- 15 Most localities are liable to have a shortage of the macro-elements such as nitrogen, phosphorus, and potassium, many are also deficient in sulphur, while some are also deficient in one or more trace elements such as cobalt which is deficient in the Rotorua-Taupo pumice country of New Zealand, selenium which is deficient in the South Island plains of New Zealand, copper, manganese, zinc, and so on. Many of the trace elements are toxic if supplied in excess and arbitrary addition to fertiliser can lead to poor plant growth and animal deaths.

- 20 As the application of fertiliser is expensive it is desirable to apply all required minerals in only one pass. This also assists in the even distribution of the trace elements.

- 25 While it is relatively simple to manufacture fertiliser in bulk to satisfy macronutrients (and such fertiliser is widely sold as superphosphate, DAP or diammonium phosphate and the like), the addition of micronutrients or trace elements in an evenly distributed form is more difficult. The resulting mixture should not separate out; which can happen if a powder of trace elements, and large granules of the macronutrients are shipped in the same container. Mixtures often have to be adjusted for particular localities and the tailoring of a mixture to economically provide a given area of land with the optimum mixture including compensation for trace element deficiency could result in costly storage.
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An ideal process would allow a fertiliser company to supplement a raw stock of granular fertiliser with a tailored mixture of trace elements as and when required; the supplement would remain attached to the granular fertiliser, and remain available for uptake after broadcasting onto the land.

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OBJECT

It is an object of the present invention to provide a modified granular fertiliser having mineral supplements, or one which will at least provide the public with a useful choice.

STATEMENT OF THE INVENTION

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In a first aspect, the present invention provides a fertiliser pellet or granule which serves also as a vehicle for minor ingredients; each granule having a core comprised of a first composition, and a coating comprised of a second composition; the second composition being bound together and onto the granule by means of a water-soluble glue of a type which sets on drying and readily releases on wetting.

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Preferably, the first composition is selected from the range of solid phosphatic fertilisers including diammonium phosphate, monammonium phosphate, superphosphate, and triple superphosphate.

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Optionally, the first composition may be urea, muriate of potash, another fertiliser, or an inert material.

Preferably, the second composition includes the glue and a customised mixture of trace elements.

Preferred trace elements include salts of boron, selenium, cobalt, copper, manganese, magnesium and zinc.

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Preferably, the glue has adhesive properties that are not substantially affected by the components of the fertiliser.

Preferably, the glue is an xanthan gum.



Alternatively the glue is a guar gum, a dextrin, or a latex based glue, or any other water-soluble glue that becomes adherent as it dries.

5. Preferably the second composition also includes powdered sulphur (also known as flowers of sulphur).

Optionally the second composition may also include other inorganic salts.

10. Optionally the second composition may also include biological material, such as bacteria or fungi adapted to fix nitrogen, or organisms capable of attacking insect pests such as grassgrubs.

Optionally the core granules may take up some dissolved trace element salts.

15. Optionally the second composition may have a layered structure in which the outermost portions are rich in sulphur.

20. In a second aspect the invention comprises a method for making fertiliser pellets or granules according to the first aspect, comprising the steps of:

- (1) mixing a water-soluble glue in water,
(2) evenly mixing the trace element salts with core granules,
(3) adding the glue and water to the mixture,
25 (4) optionally drying and packing the resulting coated granular fertiliser.

Preferably said method further includes the steps of adding a surfactant to said glue and water mixture, and once said core granules are evenly coated with said glue and water mixture adding powdered sulphur to the mixture.

30. Optionally further water is added to the mixture until the sulphur is substantially all adhered to the coated granules.

In a related aspect, another method comprises the steps of:

- 35 (1) mixing a water-soluble glue in water,

- (2) evenly mixing the trace element salts with core granules,
- (3) adding the glue and water to the mixture,
- 5 (4) evenly coating the core granules, which take up the water during this stage of the process, and
- (5) optionally further drying and packing the resulting coated granular fertiliser.

Preferably the steps of mixing are performed in a rotary mixer.

- 10 Alternatively at least some of the trace element salts may be added to the glue/water/surfactant mixture.

- Alternatively the trace element salts may be added to the mixer after adding the glue.
- 15 Preferably the surfactant is a water-soluble surfactant having properties that are not substantially affected by the components of the fertiliser.

Preferably the surfactant is an alkyl phenol polyethylene glycol ether based on i-nonyl phenol.

20 **PREFERRED EMBODIMENT**

The following is a description of a preferred form of the invention, given by way of example only.

- 25 A preferred process for making coated granules, having an interior of DAP, a first layer of a mixture of dried glue and trace elements as their salts, and an optional outer layer of sulphur, (or at least a tendency to show the above structure, somewhat blurred by partial penetration of soluble material) is summarised with the following process, where the quantities given are suitable for about 1/2 ton of fertiliser:

- 30 1. Place 390 Kg raw di-ammonium phosphate (DAP) in a suitable mixer which usually will be a rotary mixer.
2. Add the trace element mixture (TEM). Typically 17.5 Kg is used but this varies
- 35 according to the actual mixture selected for the customer.

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3. Mix, and wait until the DAP and the TEM are mixed evenly.
- 5 4. In a separate container, mix 10 litres of water with 50 gms of glue, add 25 ml of "Brydet" surfactant, and stir or beat with a whisk until blended. If sulphur is not going to be added then the surfactant may not be necessary.
- 10 5. Pour the blended glue into the rotary mixer and wait until the glue is evenly distributed over the DAP, TEM mixture.
- 15 6. Turn the rotary mixer off, and if required for the particular fertilizer add 90 Kg of ground sulphur.
- 15 7. Turn the rotary mixer on, and wait until the sulphur is evenly coated onto the granules. Should some sulphur be left, add a little more water.
- 20 8. Tip the coated granules out, optionally provide a further drying period in a rotary drier or the like, and load them into a selected container.
- 20 This process results in a granule having a core of DAP, a layer of glue and trace elements, and optionally an outer layer of sulphur with some glue and surfactant. The layering may be indistinct, and there may be a chemical reaction between different trace element salts.
- 25 The timing of the addition of the water including glue and surfactant and the duration of subsequent rolling in the rotary mixer is relatively important as the granules themselves are water-soluble and if the added watery solution is left to stand it may tend to dissolve some granules completely. On the other hand it is the period during which trace elements can penetrate the surface of the core granules. This period of exposure of granules to watery solution is known as the "dwell time". The correct dwell time will be determined by the amount of water and characteristics of the materials used. The correct dwell time will thus be determined empirically.
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Although it is generally more useful to provide a phosphatic fertiliser with added sulphur, there may be occasions wherein the sulphur is not required by the customer. Accordingly a variation of the above process omits the surfactant, the primary function

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of which is to wet the sulphur which is otherwise notoriously unwettable, and it omits the stage of adding the sulphur.

- 5 The product may not need to be further dried, if it is mixed by an experienced person and especially if the weather is not humid.

VARIATIONS

- 10 Other than DAP (di-ammonium phosphate) the granules may be composed of monoammonium phosphate, superphosphate, triple superphosphate, urea, muriate of potash (KCl), some other fertiliser, or an inert material.

- 15 Some of the trace elements may be added to the rotary mixer after addition of the glue solution, and some may be added to the glue solution. A preferred working practice is to add the "easiest-to-stick" materials first (these tend to soak into the granule core) and add the hardest materials (such as the sulphur) last.

- 20 Other than the xanthan gum of the preferred embodiment, alternatives include guar gum, dextrin gum, latex-based glues, and the like. The concentration of gum in the example is somewhat arbitrary and may be more closely determined with trials. Any alternatives that retain their adhesive properties in the presence of other substances in the above mixture are equally acceptable.

- 25 The surfactant "Brydet" (Robert Bryce & Co, Auckland) is a type of alkyl phenol polyethylene glycol ether based on i-nonyl phenol. Its main purpose is to wet the sulphur although there may be some beneficial effects after the fertiliser is broadcast. Any alternative surfactants that retain their surfactant properties in the presence of other substances in the above mixture are equally acceptable. If sulphur is not used in a customised formulation, the surfactant need not be used.
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ADVANTAGES

- 35 This process provides a granular fertiliser with supplemental additives that are caused to adhere to the surface of the granule with the aid of a glue. Some additives may be adsorbed into the mass of the basic granule during manufacture. The manufacturing

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process is relatively dust-free yet results in a product that may need very little subsequent drying, if any, before it is ready to be bagged.

- 5 The additives are compatible with ecological or anti-pollution objectives.

This process results in an improved adherence of the tailored coating to the body of the granule; as compared to our earlier processes which were very dusty during manufacture, and for which there was a tendency for the coating to flake or fall off the DAP granule and fail to be distributed evenly.

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Finally, it will be appreciated that various alterations and modifications may be made to the foregoing without departing from the scope of this invention as set forth.

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The claims defining the invention are as follows:

1. A fertiliser pellet or granule which serves also as a vehicle for minor ingredients, each granule having a core comprised of a first composition, and a coating comprised of a second composition; the second composition being bound together and onto the granule by means of a water-soluble glue of a type which sets on drying and readily releases on wetting.
2. A fertiliser pellet or granule as claimed in Claim 1 wherein the first composition is selected from the range of solid phosphatic fertilisers including diammonium phosphate, monoammonium phosphate, superphosphate, and triple superphosphate.
3. A fertiliser pellet or granule as claimed in Claim 1 wherein the first composition may be urea, muriate of potash, another fertiliser, or an inert material.
4. A fertiliser pellet or granule as claimed in any one of the preceding claims wherein the second composition includes the glue and a customised mixture of trace elements.
5. A fertiliser pellet or granule as claimed in Claim 4 wherein the trace elements include salts of boron, selenium, cobalt, copper, manganese, magnesium, and zinc.
6. A fertiliser pellet or granule as claimed in either one of Claims 4 and 5 wherein the core granules take up some dissolved trace element salts.
7. A fertiliser pellet or granule as claimed in any one of the preceding claims wherein the glue has adhesive properties that are not substantially affected by the components of the fertiliser.
8. A fertiliser pellet or granule as claimed in Claim 7 wherein the glue is an xanthan gum.
9. A fertiliser pellet or granule as claimed in Claim 7 wherein the glue is a guar gum, a dextrin, or a latex based glue, or any other water-soluble glue that becomes adherent as it dries.
10. A fertilise pellet or granule as claimed in any one of the preceding claims wherein the second composition also includes powdered sulphur (also known as flowers or sulphur).



11. A fertiliser pellet or granule as claimed in Claim 10, wherein the second composition may also include other inorganic salts.

12. A fertiliser pellet or granule as claimed in either one of claims 10 and 11 wherein the second composition may have a layered structure in which the outermost portions are rich in sulphur.

13. A fertiliser pellet or granule as claimed in any one of the preceding claims wherein the second composition may also include biological material, such as bacteria or fungi adapted to fix nitrogen, or organisms capable of attacking insect pests such as grassgrubs.

14. A fertiliser pellet or granule substantially as herein described with reference to the included example.

15. A method for making fertiliser pellets or granules according to any one of Claims 1 to 14 comprising the steps of:

- a) mixing a water-soluble glue in water;
- b) evenly mixing the trace element salts with core granules;
- c) adding the glue and water to the mixture;
- d) optionally drying and packing the resulting coated granular fertiliser.

16. A method for making fertiliser pellets or granules according to any one of Claims 1 to 14, comprising the steps of:

- a) mixing a water-soluble glue in water;
- b) evenly mixing the trace element salts with core granules;
- c) adding the glue and water to the mixture;
- d) evenly coating the core granules, which take up the water during this stage of the process; and
- e) optionally further drying and packing the resulting coated granular fertiliser.

17. A method as claimed in either one of Claims 15 and 16 and further including the steps of adding a surfactant to said glue and water mixture, and once said core granules are evenly coated with said glue and



water mixture, adding powdered sulphur to the mixture.

18. A method as claimed in Claim 17 wherein further water is added to the mixture until the sulphur is substantially all adhered to the coated granules.

5 19. A method as claimed in Claim 18 wherein alternatively, at least some of the trace element salts may be added to the glue/water/ surfactant mixture.

20. A method as claimed in either one of Claims 15 and 19 wherein the steps of mixing are performed in a rotary mixer.

10 21. A method as claimed in either one of Claims 15 to 20, wherein the trace element salts are added to the mixer after adding the glue.

22. A method as claimed in Claim 21 wherein the surfactant is a water-soluble surfactant having properties that are not substantially affected by the components of the fertiliser.

15 23. A method as claimed in any one of Claims 16, and 21 to 24, wherein the surfactant is an alkyl phenol polyethylene glycol ether based on an i-nonyl phenol.

20 24. A method as claimed in either one of Claims 15 and 16 and substantially as hereinbefore described with reference to the included example.

DATED this eighth day of September 1999.

HI TECH PRODUCTS LIMITED

By its Patent Attorneys

FISHER ADAMS KELLY

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